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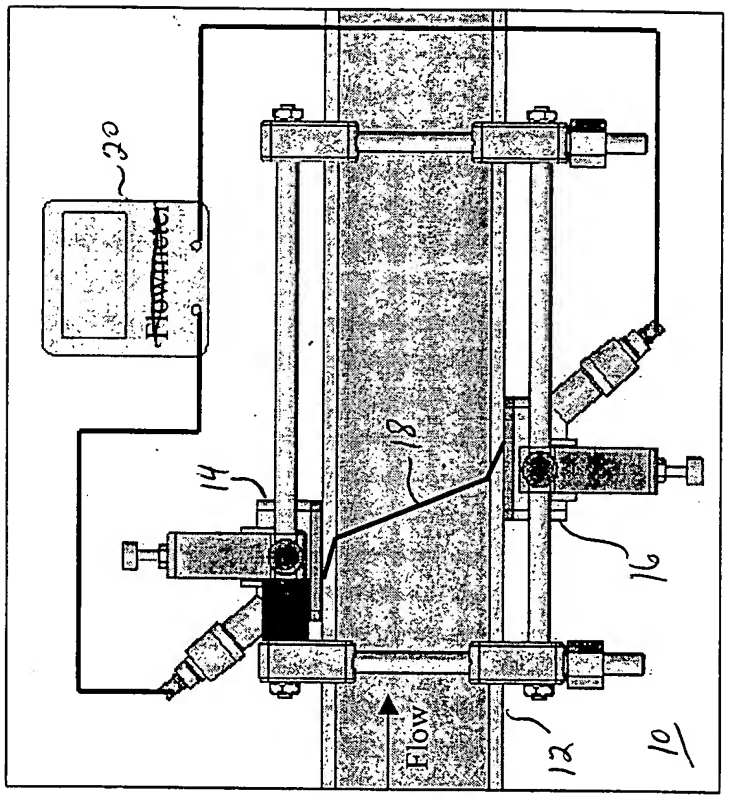


Fig. 1A

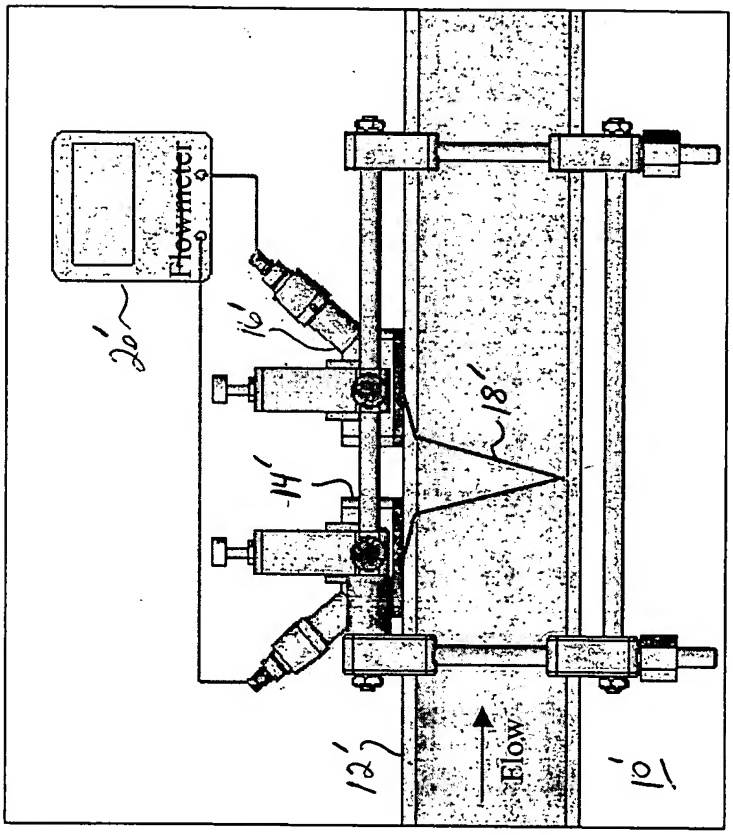


Fig. 1B

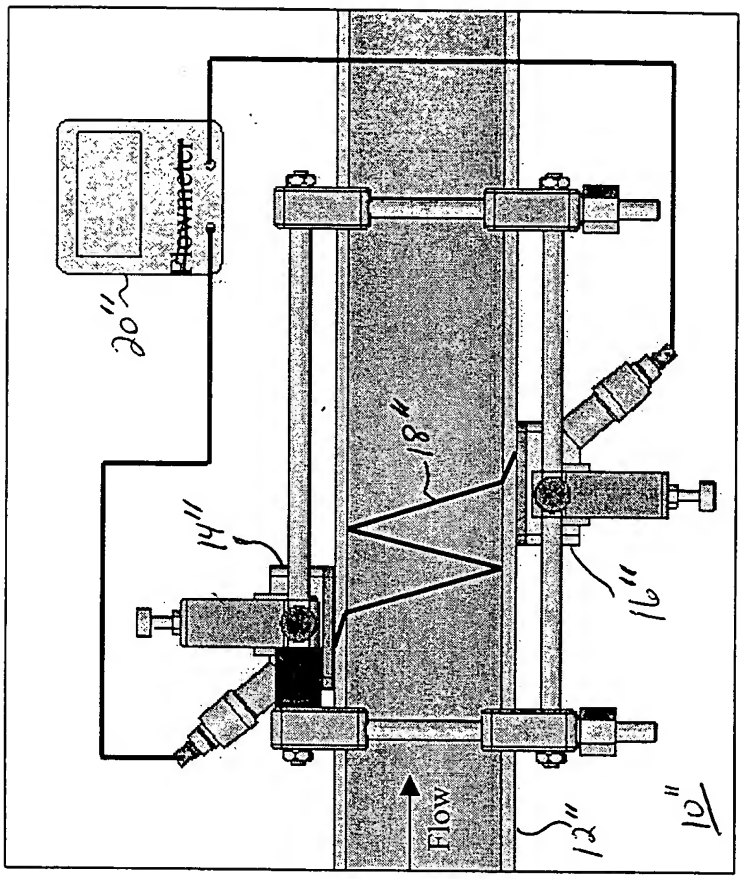


Fig. 1C

LIQUID SIGNALS:

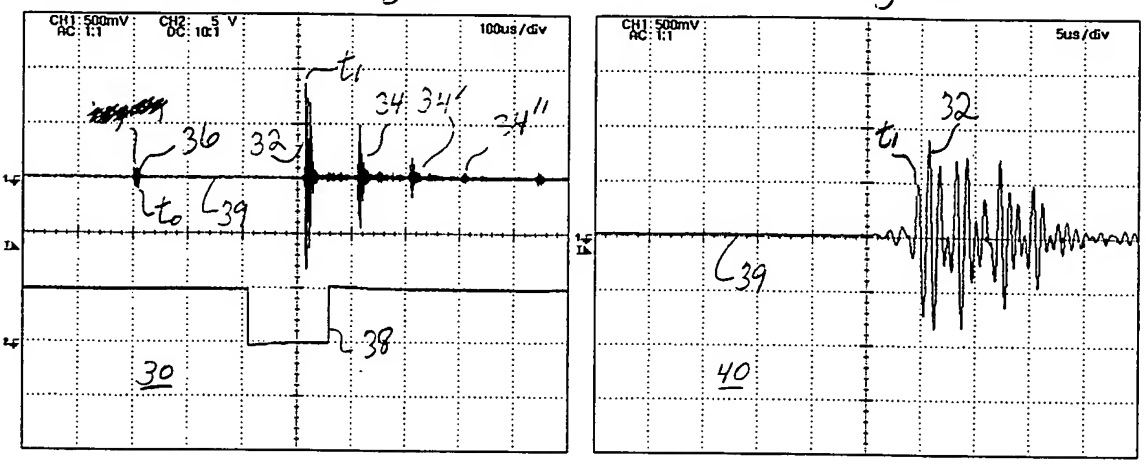


Figure 2: Left-Compressed signal and receive window acquired from wetted transducers installed in an 8-inch pipe in a single traverse, 45° configuration. The left most packet is electronic cross talk of the transmit signal, the center packet is the water-borne signal and the last two packets are the echo of that signal in the buffer. Right-Expanded view of the water-borne signal demonstrating the code that is used to determine the arrival time.

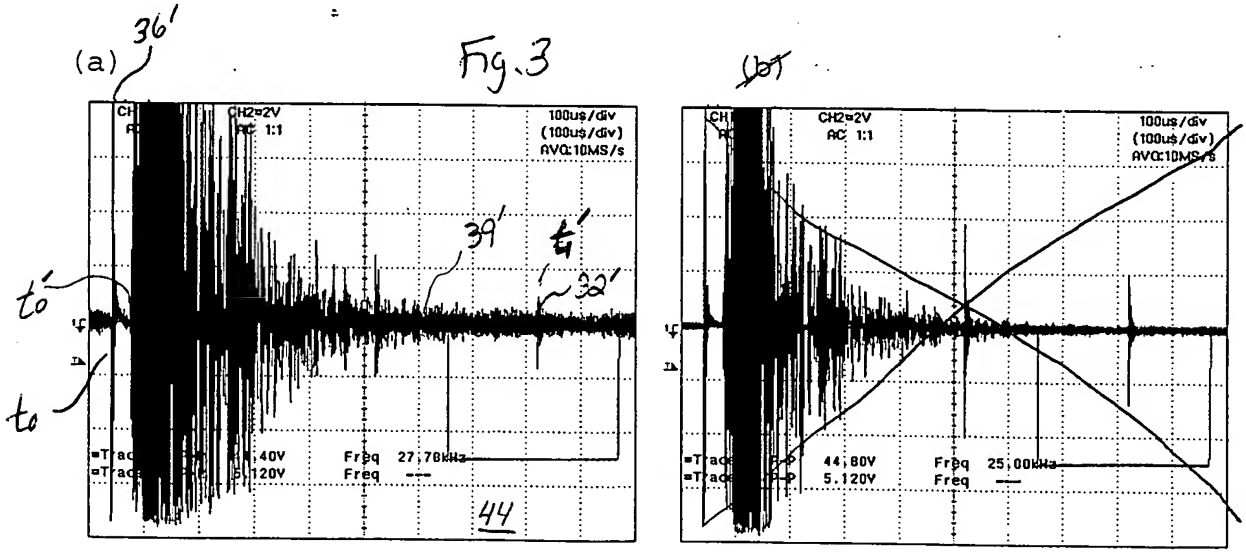


Figure 3: (a) Low signal to noise waveform received in clamp-on gas flow measurement in a 2inch diameter tube when the air pressure is 5pig. (b) A better signal signal with higher signal to noise ratio when the air pressure is at 30psig.

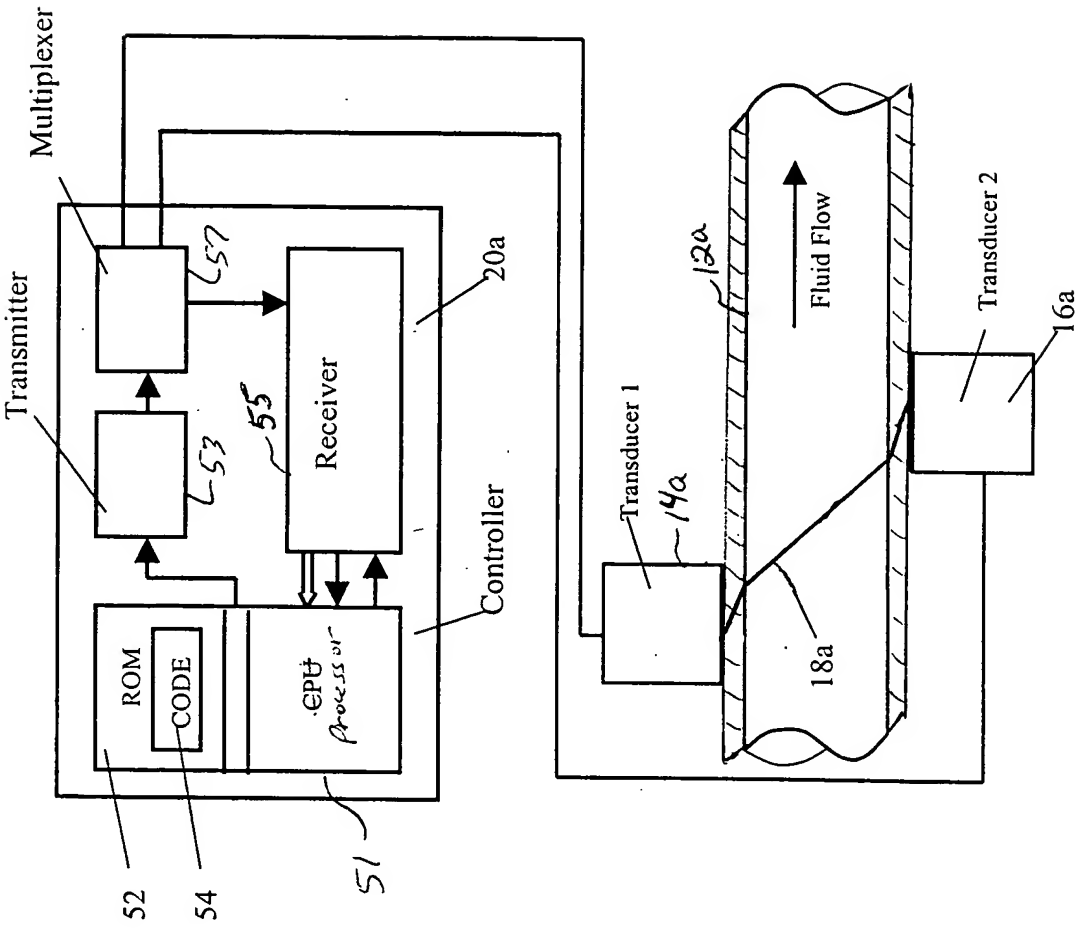

50
Multiplexer
Transmitter
57
53
55
Receiver
20a
Controller
ROM
CODE
CPU
52
54
51
Transducer 1
14a
12a
Fluid Flow
18a
Transducer 2
16a

Fig. 4

Fig. 5

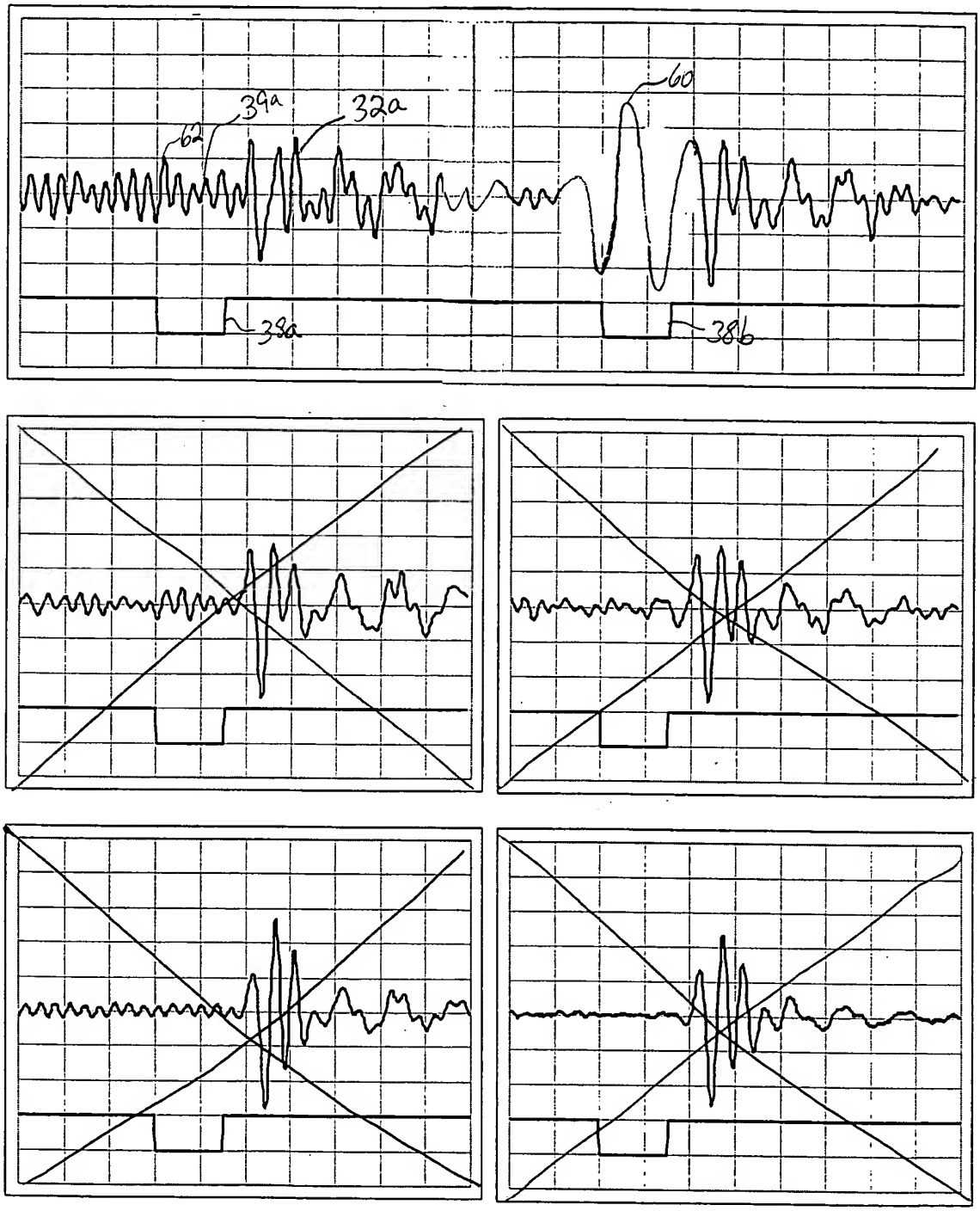
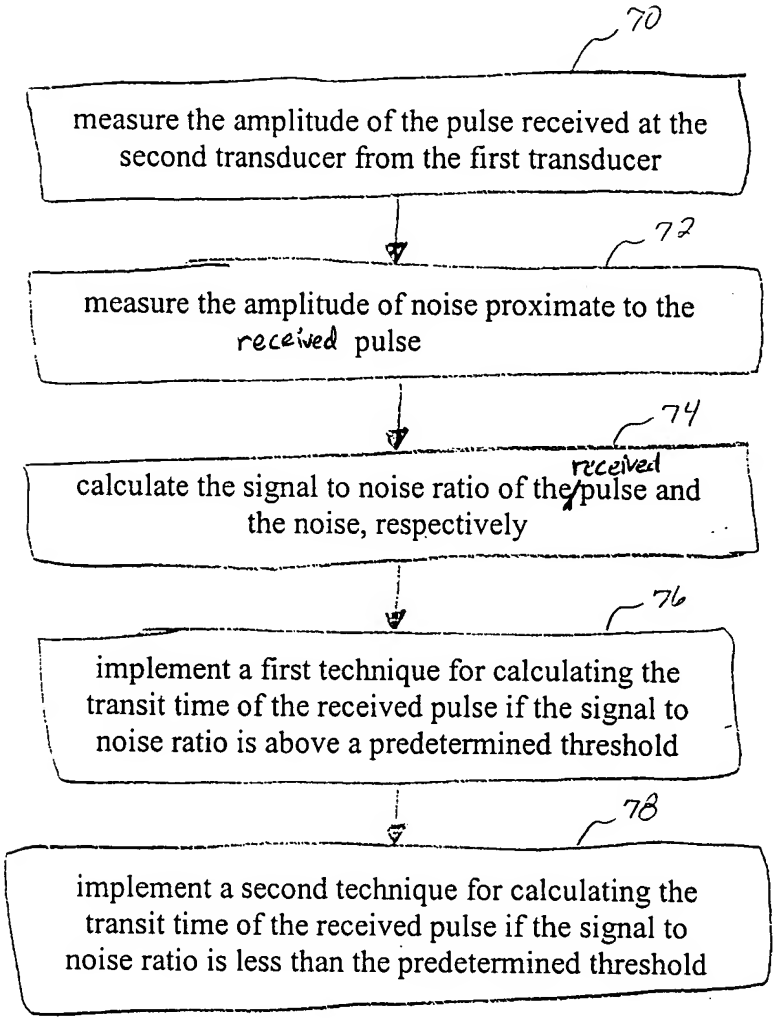


Figure 4. These graphs show a subwindow/frame located 1.5 division ahead of the arrived signal containing flow information can be used to measure the noise level and select the best timing technique to determine the signal arrival time reliably and accurately. These clamp-on gas

FIG. 6


70
measure the amplitude of the pulse received at the second transducer from the first transducer
72
measure the amplitude of noise proximate to the received pulse
74
calculate the signal to noise ratio of the received pulse and the noise, respectively
76
implement a first technique for calculating the transit time of the received pulse if the signal to noise ratio is above a predetermined threshold
78
implement a second technique for calculating the transit time of the received pulse if the signal to noise ratio is less than the predetermined threshold